RPC HV & LV OPS in the RPC FACTORY

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A	First Issue				

1.0 Purpose

The purpose of this document is to define operating procedures for the Resistive Plate Chamber (RPC) gap and detector tests including the operation of the high voltage (H.V) and low voltage (L.V) in the RPC factory in Bldg. 912. These procedures will ensure:

1.1 the safety of all personnel from risks associated with the operation of the H.V and L.V systems which are required for the operation of incoming RPC gaps, assembled detectors and the front end electronics boards (FEEs),
1.2 the implementation of the appropriate emergency procedures,
1.3 prompt notification of the appropriate CA-D and ES&H specialists,
1.4 the maintenance of appropriate CA-D emergency status,
1.5 the preservation and protection of the environment, and
1.6 the protection of BNL facilities and equipment.

2.0 Responsibilities

The first level of responsibility rests with the personnel that carry out either RPC gap or detector tests in the RPC factory. All personnel are required to obey the "two man rule".

Before and during detector tests, the responsibilities of factory personnel are:

2.1 read all safety and work planning documents, including this document, that are posted at the RPC factory and be aware of all possible hazards,
2.2 monitor the status for the H.V systems and L.V systems according to a prescribed check off list, given in Appendix A and posted in front of an electronics rack, at least once during a given test,
2.3 in the event of an alarm or irregularity, first follow the safety procedures and then contact an expert from the expert list given in Appendix B and posted in front of an electronics rack.

The second level of responsibility rests with the RPC experts. It is the responsibility of the RPC experts to:

2.4 maintain safe testing condition. This includes:

2.4.1 setting, adjusting, and checking the H.V and L.V power supplies,
2.4.2 posting special instructions and notifications as required, and
2.4.3 responding to irregular operation conditions and emergencies, as described in the procedures section of this document.

3.0 H.V and L.V system specifications

3.1 H.V system

The RPC H.V main frame is a CAEN SY 1527LC main frame and the H.V board used in the main frame is a CAEN A 1526.

3.1.1 CAEN SY 1527LC

- Power Requirements: voltage range 100/230 V, frequency 50/60 Hz, Power 3400 W
- Max. number of H.V boards per main frame: 8 with A 1526
- Max. output power: 2250 W (present setup: 750 W)
- Communications via RS 232 and TCP/IP
- Programmable handling of parameters and errors (possible to set and monitor channel parameters, advanced trip handling)
- Hardware current protection

3.1.2 CAEN A 1526

- 6 H.V channels/board
- individual channel controllable
- CPE 23.100.151-046 type male connector to be mated with CPE 23.100.052-045 type
- specification for each channel is following:
- Negative Polarity (Yellow LED light on as the relevant channel is on)
- Output voltage: 0-15 kV
- Max. output I: low range 100 μA; high range 1 mA
- Voltage set/monitor resolution: 1 V
- Current set/monitor resolution: 10 nA; 100 nA
- Ramp Down (per sec): 1-500 V; 1 V step
- Ramp Up (per sec): 1-500 V; 1 V step

3.2 L.V system

The RPC L.V system is based on power supplies previously used for the trace back chambers in the g-2 experiment in building 919.

- 2 L.V channels
- Max. output voltage: 24 V
- Max. output current : 4 A

4.0 Precautions

4.1 H.V system precautions

The maximum output current limit for each channel is set to be 100 μA in hardware. All open high voltage cables and connections are enclosed within grounded detector frames, the dark current test stand enclosure or within the grounded enclosure of power supplies and electronic modules in order to eliminate the possibility of personnel getting in contact with high voltage. When the back door of electronics rack is closed all H.V points are inaccessible to personnel. During RPC gap or detector tests with H.V on, a H.V warning sign will be posted in the RPC test area to alert personnel to the H.V status.

4.2 L.V system precautions

RPC uses high current low voltage power supplies to provide the power required for the front end electronics boards (~ 5 V, ~ 1 A, ~ 5W per FEE board). This power is distributed from the L.V power supply to the detectors and on the detectors fanned out to the FEE. Since the voltage is low, the L.V circuits may stay energized in the presence of personnel carrying out work related to the detector or gap tests. However, if work is to be performed on the FEEs the low voltage will be turned off first.

5.0 Standard Operating Procedures

5.1 H.V System Procedures: Turning on H.V to the RPC

5.1.1 Run through the check off list in Appendix A: steps 1.1 – 1.7.
5.1.2 Turn the power-on key to the right position (LOCAL).
5.1.3 Check that the appropriate current limits (max. 20 μA) and H.V limits (max. 11000 V) in software are in place for the each H.V channel. The RPC experts and personnel assigned to operate the RPC H.V shall maintain a H.V logbook where the operating parameters of the H.V setting are recorded.
5.1.4 Check that the ramp up rate for each channel is appropriate (max. 100 V/sec).
5.1.5 Starting ramping up H.V and place the "H.V ON" sign in a prominent position.

Procedure for ramp up:

- ✓ Monitor output current value and wait to stabilize RPC gap/detector (< 30 min) between steps
- ✓ Each 1000 V/step (0-8000 V)
- ✓ Each 100 V/step (8000-11000 V)

5.1.6 If any of the H.V channels trips, disable all channels until the reason for the trip is understood and call RPC experts listed in Appendix B and posted in front of an electronics rack. If the reasons for the trip are understood, then

begin the procedure again from 5.1.1.

5.1.7 When ramping is complete for the RPC gap/detector test, the RPC experts and personnel assigned to operate the RPC H.V shall record the H.V status in the H.V logbook.

5.1.8 H.V is ready for the RPC test.

5.2 H.V System Procedures: Turning off H.V to the RPC

5.2.1 Begin ramping down the H.V (max. 200 V/sec).

5.2.2 Verify by the read back that the H.V is off in each channel.

5.2.3 Turn the power-on key to the middle position (OFF).

5.2.4 Remove the "H.V ON" sign.

5.2.5 Switch off the main power on the back panel of H.V power supply if there won't be a scheduled test within 2 hours.

Appendix A: H.V check off list

1.1 Verify with personnel assigned to prepare the RPC gap for the test or who have assembled an RPC detector that the RPC gap/detector is ready for testing.
1.2 Make sure that the RPC gap and all high voltage connections from the gap are safely enclosed within the detector frame or the dark current test stand enclosure.
1.3 Check that the gap high voltage input is connected to the CPE high voltage cable.
1.4 Check that the other end of the CPE cable is connected to the H.V power supply properly. If you find an improper connection, you must first correct it. Any unmated connections with the RPC gap or detector must be removed. It is strictly forbidden to turn on the H.V main frame with an open CPE cable in the setup.
1.5 Check that the cooling fan at the top of the electronics racks, where H.V/L.V supply is located, is running. If the cooling fan is not running, contact Frank Toldo (x7788, fatoldo@bnl.gov) to fix it.
1.6 Switch on the main power on the back panel of H.V power supply.
1.7 Close and lock the back door of electronics rack.

- The factory personnel must carry out the following list of checks at least once per test. The RPC expert on duty will carry out this list of checks once every shift.

  - ✓ All cooling fans at electronics racks are operating
  - ✓ Voltages and currents at all L.V and H.V channels are correctly set.
  - ✓ Temperature of H.V channels

Appendix B: List of RPC experts
Young Jin Kim: x3805, x1078, yjkim97@uiuc.edu
Ralf Seidl: x3744, rseidl@uiuc.edu
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